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DECLARATION

The undersigned, Jan McLin Clayberg, having an office at 5316 Little Falls Road, Arlington, VA 22207-1522, hereby states that she is well acquainted with both the English and German languages and that the attached is a true translation to the best of her knowledge and ability of the specification and claims of international patent application PCT/EP 2002/053183 of MILLER, H. P. ET AL., entitled "REGULATOR UNIT AND GENERATOR".

The undersigned further declares that the above statement is true; and further, that this statement was made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or document or any patent resulting therefrom.

  
Jan McLin Clayberg

REGULATOR UNIT AND GENERATOR

## Prior Art

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From the prior art, a previously used generator with a regulator unit is known. This regulator unit serves to vary an exciter current of a rotor of this generator. This regulator unit has a housing, with which a wiper contact mounting region with a guide and wiper contacts seated therein is integrated. The electronic controller unit and a likewise electronic regulator heat sink are received in a regulator

10 housing portion, and this regulator heat sink is relatively large and extends over large regions between two through openings, which serve to fasten the controller unit to an end plate of the generator. There was a need for a new design of the regulator unit, to improve the cooling of the regulator heat sink.

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## Advantages of the Invention

The regulator unit of the invention having the characteristic of the main claim has the advantage that because of the location of the regulator heat sink between

20 the wiper contact mounting region and the plug element, a markedly improved cooling action is possible. Both the wiper contact mounting region and the plug element bring about air guidance, so that markedly more air is directed across the regulator heat sink.

25 By the provisions recited in the dependent claims, advantageous refinements of the regulator unit of the main claim are possible. Because the wiper contact mounting region is located asymmetrically between the first through opening and the second through opening, an especially great spacing can be made possible between the wiper contact mounting region and the plug element. The quantity of

30 cooling air is accordingly increased. While in the previous version the heat sink extends over wide regions between the through openings, and thus leads to especially high rigidity of the regulator heat sink, in the new design good vibration fatigue strength is also possible because the guide of the wiper contact mounting region, or its center line, has as its shortest spacing from the through opening of

maximally 20 mm.

A further provision for improving the vibration fatigue strength of the regulator unit is attained by providing that for the through openings, by way of which the  
5 regulator unit can be fastened to the housing, and the center line of the wiper contact mounting region, certain angular spacings are defined.

To further optimize the vibration fatigue strength, it is provided that there is a  
10 further fastening point, between the second through opening and the wiper contact mounting region, which is located in a defined spacing range from the second through opening.

It is also provided that the second through opening and the further fastening  
15 point each have one bearing face for a mounting element, and the bearing faces are located at different levels in the axial direction of the through opening, preferably being spaced apart in this direction by up to a defined spacing.

Because of the location of the wiper contact mounting region and the plug  
20 element between the first through opening and the second through opening, it becomes possible for the corresponding base of the end plate not to block the flow courses, aligned with the through openings, across the regulator heat sink.

Because the wiper contact mounting region with its guide, the regulator  
25 housing portion, and the plug element are a single housing part integrally with one another, a compact housing is obtained.

## Drawings

In the drawings, one exemplary embodiment of a regulator unit of the invention  
30 is shown.

Fig. 1 in a three-dimensional view shows a regulator unit of the invention;

Fig. 2 shows some dimensional ratios of the regulator unit;

Fig. 3 is a detail showing a section through the regulator unit;

Fig. 4 is a three-dimensional view of a regulator unit and its location on a  
5 housing part;

Fig. 5 shows a side view on the housing part and the regulator unit.

#### Description

10 In Fig. 1, a three-dimensional view of a regulator unit 10 is shown. This regulator unit 10 serves to vary an exciter current of a rotor of an electrical machine, particularly a motor vehicle generator. This regulator unit 10 has a housing 13, which comprises various integrally joined-together housing portions.  
15 These housing portions includes first a so- called wiper contact mounting region 16, which essentially comprises a brush holder 81 with a guide 19. Wiper contacts 22 are located in this brush holder 81. The wiper contacts 22 are displaceable in this brush holder 81. On the open end of the brush holder 81, two plates 82 are located diametrically opposite one another. They serve to protect a wiper ring unit  
20 that contacts the wiper contacts 22. The plates 82 are formed integrally onto the brush holder 81. Diametrically opposite the open end of the brush holder 81, a closure 83 serves to close the side facing away from the open end of the brush holder 81. The closure 83 is preferably fastened to the brush holder 81 by means of a snap connection.

25 The wiper contact mounting region 16 is adjoined integrally by a regulator housing portion 25, as a further housing portion. An electronic controller unit, not visible here, is received in this regulator housing portion 25. This controller unit is located below the regulator heat sink 28. This regulator heat sink 28 is relatively  
30 large in area and covers the entire regulator housing portion 25. The regulator heat sink 28 is of aluminum and has some cooling fins on its surface.

This regulator housing portion 25 is adjoined by the next housing portion, the portion which carries a plug element 31. This plug element 31 serves to connect

the regulator unit 10 electrically with external contact elements.

It is additionally provided that the regulator unit 10 has a first through opening 34 and a second through opening 37. They both serve as fastening points. By means of these two through openings, the regulator unit 10 can be fastened to a housing by means of two bolt elements. It is provided that the wiper contact mounting region 16 is located between the regulator housing portion 25 and the first through opening 34. It is also provided that the portion having the plug element 31 is located between the regulator housing portion 25 and the second through opening 37.

Thus the regulator unit 10 has as an essential characteristic that the regulator heat sink 28 is located between the wiper contact mounting region 16 and the plug element 31.

Thus a regulator unit 10, in particular for varying an exciter current, preferably for generators of motor vehicles, is provided, having a housing 13, where the housing 13 has a wiper contact mounting region 16 with a guide 19 and wiper contacts 22 seated therein, having a regulator housing portion 25, in which an electronic controller unit and a regulator heat sink 28 are received, having a plug element 31 for electrically connecting the regulator unit 10 to external contact elements; the regulator unit 10 has a first through opening 34 and a second through opening 37, by means of which the regulator unit 10 can be fastened to a housing 40 by means of two bolt elements 34, and the regulator heat sink 28 is located between the wiper contact mounting region 16 and the plug element 31.

As can be seen from the view in Fig. 1, it is provided that the wiper contact mounting region 16 is located asymmetrically between the first through opening 34 and the second through opening 37. This is intended for guiding the cooling air and leads to a large, radially extending cooling air cross section.

The wiper contact mounting region 16 and the plug element 31 are located between the first through opening 34 and the second through opening 37.

Some dimensional aspects of the regulator unit 10 will now be explained in further detail With the aid of Fig. 2.

5 The guide 19 of the wiper contact mounting region 16 has a center line, which may for instance be identical with an axis through a center of gravity of a wiper contact 22. The axis through the center of gravity here naturally has the same direction as the direction of motion of the wiper contacts 22. It is provided that the shortest spacing a between the center line 43 and the first through opening 34 amounts to a maximum of 20 mm. As a reference point for the spacing a to be  
10 ascertained with respect to the first through opening 34, the center point of this through opening applies.

It is also provided that the first through opening 34 has an angular spacing a from the center line 43 and the second through opening 37 has an angular spacing  
15 b from the center line 43, and the ratio between b and a is between 5.2 and 6.0, and in a second approximation preferably between 5.4 and 5.6. A ratio of 5.5 has proved to be an ideal value. As a reference point for determining the angle, the location of the generator axis, that is, the axis of rotation of the rotor, is intended.

20 In a further feature of the invention, it is provided that between the second through opening 37 and the wiper contact mounting region 16, there is a further fastening point 46, whose spacing from the second through opening 37 is between 11 mm and 36 mm. In a second approximation, a spacing c of between 25 mm and 33 mm is preferred. In a third approximation, a value between 28 mm and 31  
25 mm is provided. The third fastening point 84 is accordingly intended as a so-called (B+) terminal.

With respect to the axis of rotation of the rotor, it is provided that the first fastening point 34 is located on a radius R2 and the second fastening point 37 is  
30 located on a radius R1. With regard to the radius R1, it is provided that the difference between the two radii is between +5% and +10% ( $R1 > R2$ ). The preferred value is 7.5%.

It is provided that the second through opening 37 and the further fastening

point 84 each have one bearing face 85 for a mounting element (screw), and the bearing faces 85 are located at different levels in the axial direction (equal to axis of rotation of the rotor) of the through opening, preferably being spaced apart in this direction by up to 5 mm. The different levels are intended to be spaced apart by up to  $z = 5$  mm in the aforementioned direction. In a second approximation, a spacing of up to 2.7 mm is provided; see also Fig. 3.

A fourth fastening point 86 is also provided, which is also called a V terminal. This fourth fastening point 86 is intended to be connected to a contact of a connection plate, not shown here. This is meant to be done by means of a bolt element, such as a screw. This fourth fastening point 86 is located between the first through opening 34 and the generator axis. It is provided that the fourth fastening point 86 is located in a corridor between the first through opening 34 and the generator axis, and the corridor, with respect to a connecting line between the first through opening 34 and the generator axis, amounts to a width  $b_K$  of between +3 mm and -3 mm. A corridor of between +1 mm and -1 mm (Fig. 2) is especially preferred. The contemplated value is 0.9 mm. This provision leads to better guidance of the cooling air.

Fig. 4 is a three-dimensional view of the regulator unit 10 and its position on a housing part 40 of the generator. The first through opening 34 and the second through opening 37 are intended to serve, by means of bolt elements not shown, for fastening the regulator unit 10 to the housing 40.

With respect to Fig. 5, it is noted here that between the regulator housing portion 25 and the housing 40 of the generator, in its axial direction or the direction of the axis of rotation, a spacing  $c$  of between 0.5 and 5 mm, preferably between 1.8 and 3.2 mm is obtained. 2.6 mm has proved to be the best value.

For the generator, it is provided that it has, among other elements, the housing 40 and the regulator unit 10, and this regulator unit is fastened by means of two bolt elements to a rectifier heat sink and to a connection plate. The generator has an axis of rotation 55, from which the first through opening 34 has a spacing  $R1$  and the second through opening 37 has a spacing  $R2$ , and  $R1$  is between 5% and

10% greater. The fastening point 58 serves the purpose of contacting and fastening to a connection plate and is located between the first through opening 34 and the axis of rotation 55. The fastening point 58 is located in a corridor between the first through opening 34 and the axis of rotation 55, and the corridor amounts to between +3 mm and -3 mm with respect to a connecting line between the first through opening 34 and the axis of rotation 55. The regulator housing portion 25 has a spacing from the end plate 40 in the direction of the axis of rotation of between 0.5 and 5 mm, and preferably between 1.8 and 3.2. The regulator unit 10 is fastened to the housing 40 by means of the two bolt elements in such a way that it is optionally prestressed by means of bearing points.